

## 1 COMPUTING LIMITS

Complete the chart below as we work through the examples.

**Theorem 1** (Limit laws). *If  $L, M, c$  and  $k$  are real numbers and*

$$\lim_{x \rightarrow c} f(x) = L \quad \text{and} \quad \lim_{x \rightarrow c} g(x) = M, \quad \text{then}$$

(a) *Sum rule:*  (1)

(b) *Difference rule:*  (2)

(c) *Constant multiple rule:*  (3)

(d) *Product rule:*  (4)

(e) *Quotient rule:*  (5)

(f) *Power rule:*  (6)

(g) *Root rule:*  (7)

(1) Compute the following limits:

$$(a) \lim_{s \rightarrow \frac{2}{3}} (8 - 3s)(2s - 1).$$

$$(b) \lim_{y \rightarrow 2} \frac{y + 2}{y^2 + 5y + 6}.$$

$$(c) \lim_{z \rightarrow 4} \sqrt{z^2 - 10}.$$

$$(d) \lim_{x \rightarrow 1} \frac{x - 1}{\sqrt{x + 3} - 2}.$$

$$(e) \lim_{x \rightarrow -3} \frac{2 - \sqrt{x^2 - 5}}{x + 3}.$$

$$(f) \lim_{x \rightarrow -6} \frac{x + 6}{x^2 + 4x - 12}.$$

$$(g) \lim_{x \rightarrow 2} \frac{x^4 - 16}{x - 2}.$$

$$(h) \lim_{x \rightarrow 16} \frac{4 - \sqrt{x}}{16x - x^2}$$

$$(2) \text{ If } \lim_{x \rightarrow -2} \frac{f(x)}{x^2} = 1, \text{ find } \lim_{x \rightarrow -2} f(x).$$

$$(3) \text{ If } \lim_{x \rightarrow 2} \frac{f(x) - 5}{x - 2} = 4, \text{ find } \lim_{x \rightarrow 2} f(x).$$

(4) True or false? Justify.

(a) If  $\lim_{x \rightarrow 5} f(x) = 0$  and  $\lim_{x \rightarrow 5} g(x) = 0$ , then  $\lim_{x \rightarrow 5} f(x)/g(x)$  does not exist.

(b)  $\lim_{x \rightarrow 4} \left( \frac{2x}{x-4} - \frac{8}{x-4} \right) = \lim_{x \rightarrow 4} \frac{2x}{x-4} - \lim_{x \rightarrow 4} \frac{8}{x-4}.$

(c) If neither  $\lim_{x \rightarrow a} f(x)$  nor  $\lim_{x \rightarrow a} g(x)$  exists, then  $\lim_{x \rightarrow a} [f(x) + g(x)]$  does not exist.